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DIALLEL CROSSES ANALYSIS FOR IMPROVING FABA BEAN (*Vicia faba* L.) UNDER RAIN-FED CONDITIONS

2- STRESS SUSCEPTIBILITY INDEX (DROUGHT TOLERANCE)

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The present study was conducted during 1998/99 and 1999/2000 seasons to estimate the type and relative amount of genetic variance components and their interactions with experimental conditions for yield and yield components in faba bean. A half diallel set of crosses involving seven parental varieties namely, Giza blanka (P_1), Giza-717 (P_2), Triple white (P_3), Giza-643 (P_4), Giza-461 (P_5), Moshtohor-109 (P_6) and Moshtohor-103 (P_7) were utilized under two experimental conditions, the first was normally irrigated at once every 45 days in addition to the amount of rainfall, and the second, dry method of sowing was used with one supplemental irrigation at sowing, then plants were left to grow under rainfall conditions. The parents and their 21 F_1-crosses were evaluated in a randomized complete block design with three replications in Maryout Research Station, Alexandria Governorate. Data were recorded on individual plant mean basis and analyzed by the procedure developed by Griffing (1956) as model-1 method-2. The combined analysis was calculated for the two experimental conditions.

The obtained results could be summarized as follows:
Mean squares of genotypes parents, crosses and parents vs. crosses were highly significant for stress susceptibility index (SI) of yield and its components except parents vs. crosses for SI for number of pods/plant and 100-seed weight.

The mean squares associated with general and specific combining abilities were significant for SI of yield and the three yield components. Also, low general / specific-combining ability (G.C.A/S.C.A.) ratio of less than unity were detected for number of seeds/plant, seed yield/plant and 100-seed weight.

The parental cv. Giza-461 (P_5) seemed to be the best combiner for SI of number of seeds and seed yield/plant. At the same direction, it gave significant negative value for SI of 100-seed weight. The parental cv. Triple white (P_3) expressed negative significance SI for number of pods/plant and 100-seed weight. While, the parental cv. Giza-643 (P_4) was highly tolerant for 100-seed weight. Therefore, the two parental cvs. Giza-717 (P_2) and Giza-461 (P_5) could be considered as excellent parents in breeding programs towards releasing tolerant variety for drought stress.

Keywords: faba bean, stress susceptibility index, drought, genotypes.

Breeding improved genotypes for the arid and semi-arid areas by selecting solely for seed yield is difficult because the amount and temporal distribution of available moisture varies from year to year. The genotypic yield variance is low under such conditions because plant character that influence performance have differing opportunities for expression in successive years. Plant breeders (Blum, 1983 and Rosenow *et al.*, 1983) and plant physiologists (Bidinger *et al.*, 1982 and Garrity *et al.*, 1982) believe that better-adapted and higher-yielding genotypes can be bred more efficiently and effectively if attributes that confer drought resistance could be identified and used as selection criteria. However, there are few examples where this approach has been used, and even fewer where it was successful (Passioura, 1981 and Richards, 1982).

Empirical selection for improved variety performance under drought conditions has occurred since early times as countless crops have been exposed to the region of drought. With the development of modern plant breeding concepts, the process has been progressively refined and countries with active hybridization using recognizable superior genotypes, followed by selection in a regime involving exposure to drought conditions. The genetical information on faba beans may help the breeder in designing suitable program to develop well-adapted cultivars to drought stress conditions.

The present study involved information on the genetic parameters for susceptibility index (SI) concerning four traits of yield and its components in faba bean crosses evaluated under different environmental stress conditions.

MATERIALS AND METHODS

This study was carried out in the wire green-house in the headquarters (1998/99) of Marout Research Station, Alexandria Governorate (1999/2000), Desert Research Center where the soil is sand clay loam, non saline (Ec 4.83 ds/m), calcareous (27.73% $CaCO_3$) and 0.81% organic matter during 1999/2000 growing season. Seven parents of wide divergent origins of faba bean were used in the present study, i.e., Giza blanka (P_1), Giza-717 (P_2), Triple white (P_3), Giza-643 (P_4), Giza-461 (P_5), Moshtohor-109 (P_6) and Moshtohor-103 (P_7). The last two lines produced upon plant breeding program at Dept. Agron., Fac. Agric. Moshtohor, Zagazig Univ., Egypt (El Hosary and Sedhom, 1989).

A diallel crosses set involving the seven parents was made in winter season of 98/99 in wire cages under normal conditions of Desert Research Center, Matareya, Cairo.

In 1999/2000 season, two experiments were conducted, each experiment included the seven parents and their 21 F_1 hybrids, which were sown on 20th November, 1999 in a randomized complete blocks design R.C.B.D. with three replications. The two experiments were planted in two adjacent fields to avoid the differences in soil productivity. The first experiment was normally irrigated at once every 45 days in addition to rainfall. In the second experiment, dry method of sowing, was used with one supplemental irrigation at sowing, after which, plants were left to grow under rainfall conditions (stress environments). The amount of rainfall was 132 mm at the growing season. In both experiments, fertilization at the level of 100 kg P_2O_5/fed. was added before sowing. All other agricultural practices were carried out as usual in the conventional faba bean fields. In each experiment, the plot consisted of four ridge and each ridge was five-meter long and 60 cm width. Hills were spaced at 20 cm one seed hill on one side of the ridge.

The Studied Characters

In each experiment, data concerning the following traits were recorded on 10 individual plants chosen at random from each plot; number of pods per plant, number of seeds per plant, seed yield per plant (g) and 100-seed weight (g). The data obtained for each traits was analyzed on individual plant mean basis. An ordinary analysis of variance for R.C.B.D. was performed according to Snedecor and Cochran (1967). Heterosis was also determined according to Paschal and Wilcox (1975) for individual crosses as the percentage deviation of F_1 mean performance from the better parent mean (BP) for each experiment as well as the combined analysis as follows:

The better parent heterosis = $[(\overline{F_1}-\overline{BP}) / \overline{BP}]\times 100$

General and specific combining ability estimates were obtained by employing Griffing's (1956) diallel cross analysis designated as model-1 method-2.

Data of yield and its components were used to estimate the stress susceptibility index (SI). An SI was used to characterize relative stress tolerance of all genotype. The susceptibility index was calculated from normal irrigation (normal environment) and the stress environment (one supplemental irrigation at sowing and rainfall). SI was calculated according to Fischer and Maurer (1978) as follows:

$SI = [(1 - (y_{ij}/y_{ic}) / (1 - (y - j)/(y - c)]$

Where;

y_{ij} = Grain yield of the i^{th} genotype in the j^{th} drough treatment.

y_{ic} = Grain yield of the same genotype in the control treatment.

y-j = Mean grain yield over all genotypes in the j^{th} drought treatment.

y-c = Mean grain yield over all genotypes in the control treatment.

RESULTS AND DISCUSSION

Mean squares for SI of yield and some of yield components are presented in table (1). Mean squares of SI genotypes, parents, crosses and parents vs. crosses were highly significant for yield and its components except parent vs. crosses for number of pods/plant and 100-seed weight. Such results indicated the wide diversity between the parental materials used in this study.

TABLE (1).Observed mean squares from ordinary analysis and general and specific combining ability (G.C.A. and S.C.A.) of variance for stress susceptibility index (SI) of yield and yield components in F_1 generation and parents.

Source of variance	d.f	SI for No. of pods/plant	SI for No. of seeds/plant	SI for 100-seed weight	SI for seed/plant
Blocks	2	0.009	0.003	0.006	0.012
Genotypes	27	0.358**	0.515**	1.350**	0.632**
Parents (P)	6	0.271**	0.257**	0.773**	0.323
Crosses (C)	20	0.402**	0.606**	1.586**	0.709**
P.vs.c.	1	0.021	0.243**	0.100	0.952**
Error	54	0.033	0.021	0.036	0.027
G.C.A.	6	0.228**	0.132**	0.224**	0.198**
S.C.A.	21	0.089**	0.183**	0.515**	0.215**
Error term	54	0.011	0.007	0.012	0.009
G.C.A./ S.C.A.		2.562	0.721	0.440	0.921

** indicate significant at 0.01 level of probability.

Mean performance of the seven parents of faba bean and its combination crosses for SI are presented in table (2). The susceptibility index was used to estimate relative stress injury because it accounted for variation in yield potential and stress intensity. Low stress susceptibility (S < 1) is synonymous with higher stress tolerance (Fischer and Maurer, 1978).

Application of SI for yield and some yield components based on the data over both environments the parents; Giza- 717 (P_2) and Giza blanka (P_1) gave the desirable SI for yield and its three components, followed by Giza-461 (P_5) for seed yield/plant, 100-seed weight and number of seed/plant. The parental variety Triple white (P_3) expressed the desirable SI for number of pods/plant, and Moshtohor- 103 (P_7) for number of pods/plant and number of seed/plant. However, the parent Giza- 643 (P_4) and Moshtohor- 109 (P_6) exhibited low SI for yield and yield components.

The mean values of SI for F_1 hybrids are presented in table (2); of all hybrids, eleven, thirteen and fourteen ones had the highest tolerance of stress environments for number of pods/plant, seeds/plant, seed yield/plant and the 100-seed weight, respectively. The crosses; Giza- 717 (P_2) × Moshtohor- 103 (P_7) and Giza- 717 (P_2) × Triple white (P_3) for number of pods/plant, Giza blanka (P_1) × Giza- 461 (P_5), Giza- 717 (P_2) × Triple white (P_3) and Giza- 643 (P_4) × Giza- 461 (P_5) for number of seed/plant, Giza- 717 (P_2) × Moshtohor- 103 (P_7), Giza- 717 (P_2) × Moshtohor- 109 (P_6), Giza blanka (P_1) × Moshtohor- 109 (P_6), Giza- 717 (P_2) × Giza- 643 (P_4) and Giza- 461 (P_5) × Moshtohor- 109 (P_6) for 100-seed weight and the crosses; Giza blanka (P_1) × Giza- 461 (P_5), Giza- 717 (P_2) × Moshtohor- 109 (P_6) and Giza- 643 (P_4) × Giza- 461 (P_5) for seed yield/plant seemed to be the best drought tolerant ones for these traits. However, the crosses; Giza- 717 (P_2) × Moshtohor- 109 (P_6) and Triple white (P_3) × Giza- 461 (P_5) were the most drought tolerant crosses for seed yield and its studied components. Also, the crosses involve in Giza- 461 (P_5) or Giza- 717 (P_2) gave the best tolerance for seed yield/plant, therefore, these two varieties seemed to be the best parents for drought tolerance.

Heterosis

Mean squares for parents vs. crosses as an indication to average heterosis in overall crosses were significant for SI of number of seeds/plant and seed yield/plant (Table 1). The parental mean values for SI were significantly higher than F_1 mean performance for both traits (Table 2).

Heterosis expressed as the percentage of F1 mean performance from better parent values for SI of number of pods and seed/plant, 100-seed weight and seed yield/plant are presented in table (3).

For SI of number of pods/plant, the cross Giza- 717 (P_2) × Moshtohor- 103 (P_7) expressed significant negative heterotic effect relative to better parent value for SI of number of seed/plant, seven crosses exhibited significant negative heterotic effect relative to better parent values. The highest negative heterotic effects were obtained from crosses Giza blanka (P_1) × Giza- 461 (P_5), Giza- 643 (P_4) × Giza- 461 (P_5), Giza- 643 (P_4) × Moshtohor- 109 (P_6), Moshtohor- 109 (P_6) × Moshtohor- 103 (P_7) and Giza- 717 (P_2) × Triple white (P_3).

For SI of 100-seed weight, three cross combinations expressed significant negative heterotic effect relative to better parent values. The high desirable heterotic effect were detected in Giza blanka (P_1) × Moshtohor- 109 (P_6), Triple white (P_3) × Moshtohor- 109 (P_6) and Giza- 643 (P_4) × Moshtohor- 109 (P_6).

For SI of seed yield/plant, six parental combinations significantly exceeded better parents. These crosses are Giza- 643 (P_4) × Moshtohor- 109 (P_6), Giza blanka (P_1) × Giza- 461 (P_5), Giza- 643 (P_4) × Giza- 461 (P_5), Giza blanka (P_1) × Giza- 643 (P_4) and Triple white (P_3) × Moshtohor- 109 (P_6) which has the best desirable heterotic effects for SI of seed yield, also showed high SI for one or more of yield components. Similar results were obtained by Grzesiak *et al.*, (1996 and 1997), Duarte and Tavares (1998), and Toker and Cagirgan (1998).

TABLE (2). Genotype mean performance for stress susceptibility index (SI) of yield and yield components in F_1 generation and parents.

Genotype	SI for No. of pods/plant	SI for No. of seeds/plant	SI for 100-seed weight	SI for seed yield/plant
Giza blanka (P_1)	0.743	0.889	0.763	0.884
Giza-717 (P_2)	0.583	0.717	0.315	0.671
Tripe-white. (P_3)	0.616	1.100	1.536	1.157
Giza-643 (P_4)	1.311	1.386	1.123	1.318
Giza-461 (P_5)	1.132	0.943	0.675	0.913
Moshtohor-109 (P_6)	1.264	1.564	1.657	1.505
Moshtohor-103 (P_7)	0.581	0.959	1.162	1.026
$P_1 \times P_2$	1.007	1.249	2.523	1.388
$P_1 \times P_3$	1.653	1.590	1.315	1.492
$P_1 \times P_4$	1.364	0.541	0.703	0.597
$P_1 \times P_5$	0.675	0.393	0.769	0.492
$P_1 \times P_6$	1.675	1.640	0.329	1.441
$P_1 \times P_7$	0.798	0.973	0.943	0.977
$P_2 \times P_3$	0.488	0.444	1.069	0.591
$P_2 \times P_4$	1.157	1.089	0.360	0.987
$P_2 \times P_5$	0.912	0.596	1.961	0.869
$P_2 \times P_6$	0.626	0.555	0.263	0.526
$P_2 \times P_7$	0.405	1.336	0.180	1.171
$P_3 \times P_4$	0.658	1.168	1.159	1.157
$P_3 \times P_5$	0.538	0.613	0.534	0.624
$P_3 \times P_6$	0.989	0.738	0.635	0.743
$P_3 \times P_7$	1.084	1.232	0.942	1.179
$P_4 \times P_5$	1.074	0.436	0.954	0.562
$P_4 \times P_6$	1.308	0.629	0.535	0.637
$P_4 \times P_7$	1.452	1.778	0.855	1.596
$P_5 \times P_6$	1.275	0.866	0.368	0.803
$P_5 \times P_7$	0.936	0.795	1.207	0.882
$P_6 \times P_7$	0.925	0.597	2.740	0.882
$\bar{x}$ Overall parents	0.890	1.085	1.033	1.011
$\bar{x}$ Overall F_1's	0.999	0.917	0.969	1.068
$\bar{x}$ Overall genotypes	0.972	0.959	0.985	0.939
L.S.D. $_{0.05}$	0.650	0.610	0.660	0.971
L.S.D. $_{0.01}$	0.750	0.710	0.760	0.580

Combining Ability

The mean squares associated with general and specific combining abilities were significant for yield and the three yield components. To give an idea about the predicated performance of single-cross progeny in each trait, the relative size of general and specific combining ability mean squares may be helpful. Low G.C.A/S.C.A ratios of less than unity were detected for number of seeds/plant, seed yield per plant and 100-seed weight, indicating the predominance of non-additive gene action in the inheritance of SI for such traits. However, results showed that the number of pods/plant expressed high G.C.A/S.C.A ratio, which exceeded the unity, indicating the predominance of additive and additive by additive types of gene action in the inheritance of SI for this trait.

Estimates of G.C.A. effects ($\hat{g}_i$) for individual parent of each trait for (SI) are presented in table (4).

The parental cv. Giza- 717 (P_2) seemed to be first combiner for SI of number of pods/plant and the second one for SI of number of seeds and seed yield/plant and it ranked the third combiner for 100-seed weight.

The parental cv. Giza- 461 (P_5) seemed to be the best combiner for SI of number of seed and seed yield/plant at the same direction it gave significant negative value for SI of 100-seed weight. The parental cv. Triple white (P_3) expressed negative significant of SI for number of pods/plant and 100-seed weight, while the parental cv. Giza- 643 (P_4) was highly drought tolerant for 100-seed weight. Therefore, the two parental cvs. Giza- 717 (P_2) and Giza- 461 (P_5) could be considered as excellent parents in breeding programs towards releasing tolerant variety for drought stress.

Significant positive correlation coefficient values between parental performance of SI and its $\hat{g}_i$ were detected for number of pods/plant (Table 4). This finding indicated that the parental materials gave a good index of intrinsic performance of their general combining ability effects. Therefore, selection among the tested parents for initiating any proposed breeding program could be practiced either on the basis of the mean performance or with similar efficiency ($\hat{g}_i$). For other traits, insignificant coefficient values were detected between the two variables. Also, it is concluded that the non-additive gene action had the greatest role in the expression of these traits, which is in complete agreement with the finding given in table (1). Similar results were obtained by Omar *et al.* (1998).

Specific combining ability effect of the parental combinations computed for SI for yield and yield components are presented in table (5). Six, nine and eleven hybrids exhibited significant negative S_{ij} for number of pods/plant, seeds/plant, 100-seed weight seed yield/plant, respectively, which indicated tolerance for drought stress. The superiority of the two crosses; Giza blanka (P_1) × Giza- 461 (P_5) and Giza blanka (P_1) × Moshtohor-103 (P_7) for SI of seed yield/plant may be due to significant negative S_{ij} of the three yield components, *i.e.* number of pods and seeds/plant and 100-seed weight. The superiority of the other crosses Giza blanka (P_1) × Giza- 643 (P_4), Giza- 717 (P_2) × Triple white (P_3), Giza- 717 (P_2) × Moshtohor- 109 (P_6), Triple white (P_3) × Giza-643 (P_4), Triple white (P_3) × Moshtohor- 109 (P_6), Triple white (P_3) ×Moshtohor- 103 (P_7), Giza-643 (P_4) × Giza- 461 (P_5) and Giza- 461 (P_5)×Moshtohor- 109 (P_6) for SI of seed yield/plant may be due to significant negative S_{ij} of SI of one or more of yield components.

TABLE (3). Percentage of heterosis in the F1 generation to better parent (BP) for the SI of yield and yield components.

Crosses	SI for No. of pods/plant	SI for No. of seeds/plant	SI for 100-seed weight	SI for seed yield/plant
Giza blanka × Giza-717	72.73**	74.20**	700.95**	106.86**
Giza blanka × Tripe-white	168.34**	78.85**	72.35**	68.78**
Giza blanka × Giza-643	83.58**	-39.15**	-7.86	-32.47
Giza blanka × Giza-461	-9.15	-55.79	13.93	-44.34**
Giza blanka × Moshtohor-109	125.44**	84.48**	-56.88**	63.01**
Giza blanka × Moshtohor-103	37.35	9.45	23.59	10.52
Giza-717 × Tripe-white	-16.30	-38.08*	239.37**	-11.92
Giza-717 × Giza-643	98.46**	51.88**	14.29	47.09*
Giza-717 × Giza-461	56.43*	-16.88	522.54**	29.51
Giza-717 × Moshtohor-109	7.38	-22.59	-16.51	-21.61
Giza-717 × Moshtohor-103	-30.29*	86.33**	-42.86	74.52**
Tripe-white × Giza-643	6.82	6.18	3.21	0.00
Tripe-white × Giza-461	-12.66	-34.99**	-20.89	-31.65*
Tripe-white × Moshtohor-109	60.55**	-32.91**	-58.66**	-35.78**
Tripe-white × Moshtohor-103	86.57**	23.82	-18.93	14.912
Giza-643 × Giza-461	-5.12	-53.76**	41.33	-38.44*
Giza-643 × Moshtohor-109	3.48	-54.62**	-52.36**	-51.67**
Giza-643 × Moshtohor-103	149.91**	78.69**	-23.86	55.56**
Giza-461 × Moshtohor-109	12.63	-8.17	-45.48	-12.05
Giza-461 × Moshtohor-103	61.10*	-15.69	78.81**	-3.40
Moshtohor- 109 × Moshtohor-103	59.21*	-40.00**	135.80**	-1.46

* and ** indicate significant at 0.05 and 0.01 levels of probability, respectively.

Stress tolerant genotypes, as defined by SI values, need not to have high yield potential since SI provides a measure of tolerance based on minimization of yield loss under stress rather than on stress yield per se.

Genotypes identified as stress tolerance using SI should possess tolerance mechanisms, which may need to be incorporated into germplasm with higher yield potential for development of high yielding and stress tolerant cultivars.

TABLE (4). Estimates of general combining ability (G.C.A) effects for SI for yield and its components of the parental varieties.

Parental variety or line		SI for No. of pods/plant	SI for No. of seeds/plant	SI for 100-seed weight	SI for seed yield/plant
Giza blanka	(P_1)	0.06*	0.09**	0.23**	0.10**
Giza- 717	(P_2)	-0.25**	-0.05*	-0.10**	-0.12**
Triple white	(P_3)	-0.14**	0.03	-0.17**	-0.04
Giza- 643	(P_4)	0.19**	0.06*	-0.13**	0.08**
Giza- 461	(P_5)	-0.04	-0.25**	-0.08*	-0.26**
Moshtohor- 109	(P_6)	0.17**	0.02	0.10**	0.14**
Moshtohor- 103	(P_7)	0.01	0.10**	0.15**	0.10**
L.S.D. 0.05 $\hat{g}_i$		0.06	0.05	0.07	0.06
L.S.D. 0.01 $\hat{g}_i$		0.09	0.07	0.09	0.08
L.S.D. 0.05 ($\hat{g}_i - \hat{g}_j$)		0.10	0.08	0.10	0.09
L.S.D. 0.01 ($\hat{g}_i - \hat{g}_j$)		0.13	0.11	0.14	0.12
r		0.75*	0.26	0.05	0.57

* and ** indicate significant at 0.05 and 0.01 levels of probability, respectively.
r = correlation coefficient between the parental performances and their G.C.A. effects.

TABLE (5). Estimate of specific combining ability (S.C.A) effect for SI of yield and yield components of F_1 generation.

Crosses	SI for No. of pods/plant	SI for No. of seeds/plant	SI for 100-seed weight	SI for seed yield/plant
Giza blanka × Giza-717	0.16	0.83**	1.46**	0.72**
Giza blanka × Tripe-white	0.71**	0.47**	-0.77**	0.18*
Giza blanka × Giza-643	0.13	-0.57**	-0.39**	-0.68**
Giza blanka × Giza-461	-0.38**	-0.42**	-0.37*	-0.48**
Giza blanka × Moshtohor-109	0.44**	-0.48**	-0.02	0.50**
Giza blanka × Moshtohor-103	-0.29**	-0.19**	-0.45**	-0.27**
Giza-717 × Tripe-white	-0.11	-0.39**	-0.48**	-0.43**
Giza-717 × Giza-643	0.21**	0.10	-0.42**	0.14
Giza-717 × Giza-461	0.18	-0.06	1.21**	-0.28**
Giza-717 × Moshtohor-109	-0.32**	-0.48**	0.09	-0.32**
Giza-717 × Moshtohor-103	-0.33**	0.31**	-0.87**	0.26**
Tripe-white × Giza-643	-0.37**	-0.43**	-0.18	-0.50**
Tripe-white × Giza-461	-0.27**	0.09	-0.38*	0.26**
Tripe-white × Moshtohor-109	-0.03	-0.28**	-0.28	-0.44**
Tripe-white × Moshtohor-103	0.23**	-0.48**	1.88**	-0.43**
Giza-643 × Giza-461	-0.07	-0.32**	0.15	-0.53**
Giza-643 × Moshtohor-109	-0.03	0.08	0.22	0.19**
Giza-643 × Moshtohor-103	0.27**	0.61**	-0.19	0.62**
Giza-461 × Moshtohor-109	0.15	-0.12	-0.48**	-0.21**
Giza-461 × Moshtohor-103	-0.02	-0.02	0.16	0.20**
Moshtohor- 109 × Moshtohor-103	-0.06	0.15*	-0.31	0.19**
L.S.D 0.05	0.19	0.15*	0.20	0.17
(S_{ij}) 0.01	0.25	0.20	0.26	0.23
L.S.D 0.05	0.28	0.22	0.29	0.25
($S_{ij} - S_{ik}$) 0.01	0.37	0.30	0.39	0.34
L.S.D 0.05	0.26	0.21	0.27	0.24
($S_{ij} - S_{kl}$) 0.01	0.35	0.28	0.37	0.31

* and ** indicate significant at 0.05 and 0.01 levels of probability, respectively.

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تحليل الهجن التبادلية لتحسين الفول البلدى تحت الظروف المطرية
٢- معامل الاجهاد البيئى (تحمل الجفاف)

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تم عمل جميع الهجن الممكنة بين سبعة آباء مختلفة وراثيا وذات أصول وراثية متباعدة وهى جيزة بلانكا، جيزة ٧١٧، Triple white، جيزة ٦٤٣، جيزة ٤٦١، مشتهر ١٠٩، مشتهر ١٠٣.

وقد اجرى هذا البحث خلال موسمى ١٩٩٩/٩٨ ، ٢٠٠٠/٩٩ فى الموسم الأول، و فى الموسم التالى أقيمت تجربة فى قطاعات كاملة العشوائية ذات ستة مكررات بغرض تقييم الآباء والهجن الناتجة منها حيث تم رى ثلاثة مكررات من التجربة كل ٤٥ يوم (معاملة الرى العادى) وتركت الثلاثة مكررات الاخرى للنمو تحت ظروف الأمطار السائدة بمنطقة مريوط التابعة لمحافظة الإسكندرية والتى بلغ متوسطها فى ذلك العام ١٣٤ مم.
هذا ويمكن تلخيص أهم النتائج المتحصل عليها كما يلى:

كان تباين معامل الحساسية للإجهاد البيئى للتراكيب الوراثية ومكوناتها معنويا للصفات تحت الدراسة فيما عدا تباين قوة الهجين لصفتى عدد القرون بالنبات ووزن الـــ ١٠٠ بذرة.

اظهرت الهجن جيزة ٦٤٣ × مشتهر ١٠٩، جيزة بلانكا × جيزة ٤٦١، جيزة ٦٤٣ × جيزة ٤٦١، جيزة بلانكا × جيزة ٦٤٣، Triple white × مشتهر ١٠٩ احسن قوة هجين مرغوب فيها لصفة محصول البذرة بالنبات.

اظهر الأب جيزة ٧١٧ أعلى القيم فى قدرته العامة على التآلف لمعامل الحساسية للإجهاد البيئى لصفة عدد القرون بالنبات.

اظهر الأب جيزة ٤٦١ قدرة عالية على التآلف لمعامل الحساسية للإجهاد البيئى لصفتى عدد البذور ومحصول البذرة بالنبات.

وبذلك يمكن اعتبار الصنفين جيزة ٧١٧، جيزة ٤٦١ احسن الآباء فى برنامج التربية الموجه لانتاج صنف يتحمل ظروف الجفاف.

حققت ستة وتسعة وثمانية و إحدى عشر هجينا معنوية سالبة لتقديرات القدرة الخاصة على التآلف لصفات عدد القرون والبذور بالنبات ووزن الـــ ١٠٠ بذرة ومحصول البذرة بالنبات على التوالى، مما يشير إلى تحمل هذه الهجن لظروف الجفاف